

## CLAIMS:

1. A detector for ionising radiation comprising a first relatively thick layer of diamond material and a second relatively thin layer of diamond material adjacent to the first layer, the layers being connected electrically to a common contact, the first and second layers being optimised for the detection of different types of radiation or for the detection of different parameters of a particular type of radiation, with respective first and second contacts connected to the first and second layers, so that the detector simultaneously provides first and second output signals corresponding to radiation incident on the detector elements.
2. A detector according to claim 1 wherein the common contact comprises a metallic or semi-conductor layer between the first and second diamond layers.
3. A detector according to claim 2 wherein the common metallic or semi-conductor layer comprises a material selected from the group consisting of titanium, tungsten, molybdenum and boron doped diamond.
4. A detector according to <sup>claim 1</sup> ~~any one of claims 1 to 3~~ wherein the first layer has a thickness of between 0.3 mm and 1.5 mm.
5. A detector according to claim 4 wherein the first layer has a collection distance of at least 20  $\mu\text{m}$ .
6. A detector according to claim 5 wherein the first layer has a collection distance of at least 50  $\mu\text{m}$ .
7. A detector according to claim 6 wherein the first layer has a collection distance of 300  $\mu\text{m}$  or more.

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8. A detector according to <sup>claim 1</sup>~~any one of claims 1 to 7~~ wherein the first layer is optimised for the detection of beta particles, x-rays and gamma rays.

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9. A detector according to <sup>claim 1</sup>~~any one of claims 1 to 8~~ wherein the second layer has a thickness of between 10  $\mu\text{m}$  and 40  $\mu\text{m}$ .

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10. A detector according to <sup>claim 1</sup>~~any one of claims 1 to 9~~ wherein the second layer is optimised for the detection of alpha particles.

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11. A detector according to <sup>claim 1</sup>~~any one of claims 1 to 10~~ further including respective conductive layers on the outer surfaces of the first and second layers of diamond material.

12. A detector according to claim 11 wherein the conductive layers comprise a material selected from the group consisting of titanium, tungsten, molybdenum and boron doped diamond.

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13. A detector according to claim 11 ~~or claim 12~~ including respective active contacts connected to the conductive layers.

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14. Radiation detector apparatus comprising a detector according to <sup>claim 1</sup>~~any one of claims 1 to 13~~, bias means arranged to apply respective bias voltages to the first and second diamond layers, and first and second amplifiers having inputs connected to the first and second diamond layers and arranged to generate respective first and second amplified output signals corresponding to radiation incident on the layers.

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